



Camp-on-a-Disk Guide

to planning, organizing and operating your own Robocamp

The Robotics Academy, an educational outreach of Carnegie Mellon University, has been operating LEGO® robotics camps ("Robocamps") for several years. The formula that we've developed has been tested on thousands of children. By following the suggestions in this guide, you can take advantage of procedures that have proven useful in real camps. You also have the flexibility to customize camp operations to suit your own unique learning environment.

Camp Sessions

This guide is divided into 10 sessions. A session is an undefined unit of time— it could be a few hours or it could be a day.

Generally, sessions are designed as half-day units of instruction. So, if you are running a two week day-camp that runs from 9:00 A.M. until 11:30 A.M. each day you would complete one session. Session 1 would start the camp. Session 2 would run on day two, and so on through Session 10.

The Robotics Academy recommends half-day camps. However, If your camp is planned for one week only, the goal would be to complete two sessions per day.

At times, it might make sense to run sessions in an order different from the way they are numbered.

Session Organizers

- **Session 1**
Administration, part identification, building your first robot
- **Session 2**
Working in ROBOLAB, programming with motors and timers
- **Session 3**
Programming with touch sensors
- **Session 4**
Programming with rotation/angle sensors
- **Session 5**
Programming with light sensors
- **Session 6**
Problem solving, integrating multiple sensors, advanced programming
- **Sessions 7 - 10**
Main competition— "Green Geyser Wilderness Park"

Teaching is a craft; each person does it differently. Every Camp Director has a different set of resources to offer their camp. Feel free to modify any and all of this material to suit your needs.

Dataloggers CD-Rom Navigation

The DataLoggers CD is divided into 4 activity areas: Lodge, Trek, Park, and Science. Sessions 1 through 6 are designed to be implemented at the Lodge and on the Trek.

Resources on the CD are identified in this document using the following protocol: (example) Lodge / Training / Touch Sensors / Bugbot. The first word "Lodge" indicates that you will find these resources in the section of the CD named Lodge. "Training" is an organizer within the Lodge section and "Touch Sensors / Bugbot" is a selection available under "Training".



Robotics Academy

The National Robotics Engineering Center

www.rec.ri.cmu.edu/education

roboed@rec.ri.cmu.edu

Start in the "Lockbox"

Before anything else, take some time to review the material in the Lockbox (accessed using the button just to the right of the Dataloggers text in teh bottom center of teh navigation).

The password is "dataloggers" (all lower case).

There are many useful items in here, ranging from essentials like registration forms and an itinerary overview to promotional posters, scoring guides and more. Here's a quick summary—

Lockbox

- **Read First**
General CD operating information, support contact info, related product installs and links
- **Forms and Posters** *(some editable in Microsoft Word®)*
Application / registration form, medical release, liability release, PR and/or informational release and color posters
- **Scoring**
Detailed list of how scoring works for DATALOGGERS activities
- **Itinerary**
Camp rules, camp goals, overview of how camp will play out
- **Gameboard**
Map / layout of gameboard with prop positions, etc.
Plans for construction of the physical board are available in the Extra Resources folder in the root directory of the CD.
- **Rules**
General guide to rules that dictate challenge play and competitions.
Can be modified at camp director's discretion.
- **Briefing**
Brief guide to logistical concerns and resources necessary to outfit and run a Robocamp.
- **Materials List**
Non-LEGO materials recommended for camp operation.
- **Master Guide**
You are reading it now.

Note that much of this material is also accessible from the root directory of the CD in a folder named Extra Resources.

The Dataloggers CD contains a wealth of resources that allow you to create an engaging educational experience in a non-traditional learning environment. The first time you use a Camp-On-A-Disk CD-Rom you'll want to click through all of the links to get a good feel for the available content before you begin the camp.

Extra Robocamp Activities

You can implement these into the robocamp at your discretion.

Robots to Build

It is difficult for students who are unfamiliar with LEGO parts to build structurally sound robots in their first attempts. The Dataloggers CD-Rom includes step-by-step instructions for building 8 robot chassis; Tankbot, Grizzly Atoms, Steamer, Rockybot, Firewalker, Mudrunner and Osprey. Our intention is to give campers structures to work with initially and then to challenge them to modify the robots to accomplish more specialized tasks.

Campers Team Pages on the Web

Not all Robocamps will have the resources to have attendees post web-based home pages, but this is a great activity that children love to participate in. If you have the capability, consider having each team create a website of their week's challenges and triumphs.

For examples, visit the Robotics Academy website, click on the link for "Robocamp" then scroll to click and view team websites from past years.



Powerpoint Presentations

Critical thinking, problem solving, and clear communicating are all skills children are asked to apply through their week in camp. If logistics allow for it, campers can be asked to create a Powerpoint presentation summarizing their week of learning and fun.

Crossword Puzzles

Science / Crosswords. These puzzles are filled with nature-oriented questions. Answers can be found on the Lockbox page (password "dataloggers").

Teams & Teamwork

Children are assigned to teams at the beginning of the Robocamp. Counselors should try to create compatible teams. The camp only lasts a week (or two) and the better each team gets along with its members the easier the learning and fun will be.

Team members are encouraged to assume different roles each day: programmer, engineer, project manager, communications specialist. There's no need to follow this rule to the letter, but we do encourage campers to share roles. Some campers only want to build, others "hog" the computer and only do programming. We monitor the situation so that all have a chance to do both.

NOTE:

There are children that will go home and tell their parents that they didn't get the opportunity to try programming or building robots. If you assign roles campers must fill throughout the week, changing their responsibilities once or twice, you will eliminate this problem to a large degree.

Graduation Day

At the end of each camp, a "graduation" can be held. The graduation ceremony does several things:

1. Gives the children an opportunity to present what they have done / learned.
2. Gives the parents an opportunity to see what their children did.
3. Brings prestige to your camp; bring the media if possible—we identify a keynote speaker that makes opening remarks.

Session 1

Welcoming campers / Building with LEGO

This next section covers the first day of camp, and is directed especially at the first time camp director. Remember that Robocamp is intended to be fun. It's a camp!

Opening Day

As parents drop children off for the first day of camp remind them when they will need to come back to pick up their children. Be sure to tell parents that if they are going to have someone else pick up their children that you should be notified in advance.

Campers will not all arrive at the same time. Have something for the "early birds" to do while waiting for the rest of the campers. Showing camp related videos on a TV or big screen (if possible) is a great way to fill this time.

The first day will involve many administrative tasks— you'll want to have everything prepared and rehearsed with your staff in advance.

- Provide **NAME TAGS** for your campers.
- Assuming that most of the campers may not know each other, it's a good idea to have some activity to allow them to ease into their new environment. A good **ICEBREAKER ACTIVITY** is to have campers interview each other and then have one camper introduce the other camper. You may want to prepare a **LIST OF QUESTIONS** for the children depending on their ages.
- Hand-out a **WRITTEN ITINERARY** of how the camp will proceed. (What's happening on day 1, day 2, etc.) Campers can take this home for parents to review.

- If your camp includes a graduation ceremony, send an **INVITATION** to the camper's parents allowing them some "lead time" to schedule the day if they wish to attend. When campers know there is a graduation ceremony where they are responsible for presentations it serves as motivation to complete activities.
- Welcome your campers & **INTRODUCE YOURSELF** and other staff members.
- Assign campers to **TEAMS**. Our suggestion is to pair boys with boys and girls with girls and also to separate children according to age.
- **ASSIGN KITS** to teams; remind them about your cleanup procedures. Make sure that you have a cleanup procedure; remember that whatever campers don't clean up you get to clean up!

Review camp rules:

- Campers will treat everyone with respect.
- Cleanup and storage procedures
- Rules for leaving the room or camp facility
- Parent pickup procedures
- Lunch or snack rules
- Your specific camp rules

Review the big picture of what campers should be learning:

- Technological literacy
- Programming
- Project Management
- Teamwork
- Problem solving
- Time management

(All qualities future employers will be looking for)

Presenting the Big Picture

The Dataloggers Green Geyser Wilderness Park Adventure

By adding your own enthusiasm to the "kick off" of the Robocamp, you can set a mood that will help your campers learn and have fun.

This week, campers (addressed as "Data Rangers" on the CD) will be journeying to the Green Geyser Wilderness Park, a fictional counterpart to Yellowstone National Park. They will be designing robots to help accomplish tasks at the park, and experience roles as engineers, programmers, designers, and researchers.

Roxie S. Rivetminder, the Dataloggers Commander-in-Chief, will assist in explaining the missions in the **Preview** slideshow, which can be found on the title page at the bottom left side of the logo.

Encourage campers to explore the Science area of this CD. A wealth of material is available there. For starters, you might direct them to review different environmental careers, or to study about how to sustain our planet through stewardship.

Remind campers that they'll be working in teams of two, three, or four depending on how the camp is set up. Since campers are encouraged to exchange roles each day, let them know the various tasks they can expect to be engaged in. Note what engineering entails, and how robots can be designed before they are built, but also the importance of "seeing" how the design might work or not as you actually put the pieces together. There's more than one way to do something right! Remind campers that one of the goals is to develop teamwork, and it is important they work as a team, giving everyone a chance to contribute equally.

Let campers know that they will complete one or two exercises / challenges each day. (You can present awards at the graduation ceremony for participation in the challenges.) The training and challenges in the **Lodge** and **Trek** sections are designed to prepare campers for the week-ending competition built around the **Green Geyser Wilderness Park Missions**.



What to cover in this session

Remember this is a camp— keep your formal presentation to a minimum, and teach concepts on a “need-to-know” basis

- Part identification (they can learn these by reading the names as they find the parts) encourage campers to use proper terminology when they discuss parts.
- Parts of the RCX (this can be taught on a need-to-know basis)
- Systems in Tankbot (this depends on the age of your campers)
- Motors and Timers demonstration
- Have campers write a few simple ROBOLAB programs

Learning Objectives for Session 1

- Learn camp rules.
- Identify what makes a robot a robot: SPA (Sense / Plan / Act)
- Identify the major components of the RCX.
- Identify the systems that make up Tankbot
 - RCX: the controller
 - The Chassis: supports all systems on the robot.
 - The Motors: move the robot (mention polarity here).
 - The Connecting Leads: send the signals from the RCX to the motors and from the sensors to the RCX.
 - Sensors: give feedback to the RCX
- Identify parts and build a complete Tankbot.

Session 2

Campers first attempts at Programming

In Session 2, campers learn how to navigate in ROBOLAB, the programming language used to program LEGO robots. (You can also use other programming languages; NQC, RIS, etc., if you desire.)

Campers can begin attempting the simple programming challenges in the [Lodge / Training](#) section. These exercises teach the campers how to program their robots to complete some basic commands: move forward, backward, turn, add modifiers, and how to use loops. Depending on the age and skill of your campers you may either point them to the answers given within the [Training](#) exercises, or challenge them to develop answers on their own. Based on the limited amount of time for Session 2 (one day) we suggest a demonstration of writing basic code to achieve certain robot “moves” and then challenging campers to revise the programming in some way.

What to cover in this session

Review from Session 1. Have campers answer these questions:

- A. What is a robot?
- B. What does the RCX do?
- C. What is a system?
- D. Name a few basic LEGO parts.

Starting ROBOLAB

Campers will need to be able to navigate to ROBOLAB, open the program, and open Inventor Level Four. Staff from the camp should demonstrate how this is done.

Storing programs

Campers should be shown where they should store their programs on the computer. They need to learn how to make a folder, name it, and store all of their work into the folder.

Basic programming

Moving Forward

- To introduce campers to ROBOLAB, have them write a simple program to make the robot move forward. This can be found in [Lodge / Training / Motors & Timers / Moving Forward](#).
- After they have completed this, have the campers modify their program so that the robot moves forward for 7 seconds.
 - Teach the campers to use the Replace Tool in ROBOLAB.

- Teach them to use modifiers. Since there is no “7-second” icon, they will need to use the question mark icon and attach a modifier (an example can be found in [Lodge / Training / Motors & Timers / Modifiers](#))

- Encourage campers to use language that is appropriate to programming, such as modifier, icon, and timer.
- Demonstrate how to download the program to the RCX. Remind campers to cover their RCX and IR tower when sending programs.

Moving Backward

- Have campers write a program to make the robot move backwards after it has gone forward. This exercise is located in [Lodge / Training / Motors & Timers / Forward/Reverse](#)

Turning

This exercise encourages campers to think about the physics of turning. They can study the physical robot for clues.

- Students must first decide which direction the wheels must turn in order to make a left turn or right turn, and note how this is different from a car. They should understand that there are three ways to make the robot turn:
 - One wheel remains stationary while the other wheel moves forward. (resulting in a wide turn)
 - One wheel moves backward while the other wheel moves forward. (resulting in a point turn)
 - One wheel remains stationary while the other wheel moves backward. (resulting in a wide turn)
- An example of how to program a point turn can be found in [Lodge / Training / Rotation Sensors / Point Turns](#).

Challenge for the Day

- Travel around a box or through a maze!

Note: we are assuming that you are starting with novice programmers. You will move through these exercises quickly if your campers are more experienced.

- Students will use their understanding of going straight and making point turns to make their robots travel in a complete square.
- In order to make this a simpler task, have your students use loops. Get the code in [Lodge / Training / Motors & Timers / Loops](#).

What might your students have trouble with today?

- Wiring the icons together can be difficult first time ROBOLAB users.
- Troubleshooting programming problems— teach campers to use the broken arrow tool, which serves as the ROBOLAB compiler.
- Moving between the hand tool, arrow tool, and wiring tool— Teach campers to use the spacebar and tab key to switch tools.
- Downloading the program to the RCX— campers will often forget to turn their robots on.
- When multiple campers are uploading programs to their RCXs they should remember to cover the IR tower and RCX or they run the risk of corrupting the firmware of other campers' robots.

Learning Objectives for Session 2

- Open up ROBOLAB
- Write basic programs to move forward, backward, turn, and navigate around a square.
- Use proper terminology
- Upload code to robots
- Troubleshoot programming problems

Session 3

Touch Sensors and Conditional Statements

In Session 3, campers will get their first experience programming sensors. Encourage campers to program using feedback from sensors instead of timing— children like timing and will try to use timing for everything.



What to cover in this session

Demonstrate how touch sensors work. **Bugbot** is a great demonstration of touch sensors that children understand and really like. (See [Lodge / Training / Touch Sensors / BugBot](#))

Explain to campers that:

- Touch sensors provide digital feedback; things are either on or off.
- When the touch sensor is pressed the circuit is being completed, which sends a signal to the controller.
- The RCX shows feedback the robot is getting on the view screen.

A example of how touch sensors work can be found at:

[Lodge / Hardware / Sensors / Touch Sensor](#)

Programming Exercises

Go Forward until Touch

Have campers build the touch sensor bumper; [Lodge / Hardware / Attachments / Touch Sensor](#).

Challenge the campers to write a program that will make their robot move forward until the touch sensor hits the wall. When it hits the wall the robot should move backward, turn, and move forward again. ([Lodge / Training / Touch Sensors / Wait For Push](#))

Note: Remind students to build robot behaviors in small parts. Write a simple behavior (move forward until it hits a wall and stops), test the behavior, and make sure that one behavior works before adding other behaviors.

Introduction to Conditional Statements

The “Wait For Touch” and “Wait For Let Go” icons introduce the concept of a “conditional statement.” In “Wait for Let Go,” the robot will continue to move forward until the touch sensor is pressed.

Wait For Let Go

Use the exercise [Lodge / Training / Touch Sensors / Wait For Let Go](#).

This is in fact more of an engineering challenge than a programming challenge. Campers will need to design a switching system that attaches to the bottom of their robots. (Hint: have them attach a touch sensor to the light sensor attachment)

“Flower Watering” Training Task

Remind students they are the new “Rangers” so they must help with the upkeep of the Naturarium – a task given to all the youngest members of the team. They have an advantage over most people given this task, though. They can use robots! Guide them to the challenge on the CD and let them come up with a solution. The exercise is found in [Trek / Shed](#).

What might your students have trouble with today?

- Since this is their first time working with sensors, students may have a difficult time remembering to add modifiers to their sensors, and/or wire their sensors into the right ports.
- You will need to teach what the default port is for each sensor (Port 1) and that the robot won’t get proper feedback unless the sensor is wired correctly to the robot.
- The icons for different functions (wait for push, wait for release, etc.) look fairly similar, so if something is not working check that campers are using the correct icon.
- The touch sensor can be difficult to use if– mechanically– the touch sensor attachment doesn’t operate smoothly. This is an engineering design problem– encourage campers to create their own solution.
- Add port modifiers to all sensor icons, even if they are using the default port. It gets campers into the habit of adding the port modifiers and will keep them out of trouble when they are using multiple sensors in future projects.

Learning Objectives for Session 3

Campers should be able to:

- Describe what a sensor is.
- Describe a conditional statement.
- Describe how modifiers are used with touch sensors.

- Read the feedback from the view screen on their robot.
- Use conditional statements to control robot behavior.
- Write programs that use touch sensors to complete director assigned challenges.
- Cooperatively work in teams.

Session 4

Introduction to Rotation / Angle Sensors

The rotation sensor (also known as an angle sensor) is a powerful tool that campers can use to move point to point on the board. To review how the rotation sensor gives feedback to the RCX go to [Lodge / Hardware / Sensors / Rotation Sensors](#). There are a variety of challenges for campers that will help them learn how to integrate rotation sensors into their robot design. Since this is a camp, and children should be learning by doing, many of these concepts can be taught on a need-to-know basis.

An example that demonstrates one way to connect a rotation sensor can be found in [Lodge / Hardware / Attachments / Rotation Angle I](#).

In this session campers will be challenged to:

- Add a rotation sensor to their robots:
[Lodge / Hardware / Attachments / Rotation Angle I](#)
- Program their robots to use a rotation sensor
[Lodge / Training / Rotation Sensors / Move Straight Training / Training / Rotation Sensors / Point Turns](#)
- Complete a Datalogger challenge that uses rotation sensor feedback
[Trek / Puppy](#)
[Trek / Plants](#)

What to cover in this session

Build a few robots programmed with rotation sensors so that you can demonstrate how they work. Take a few minutes and explain the following to the campers:

- A rotation sensor works better than programming with timing. As the battery level of the RCX changes, the speed of the robot decreases and so does the distance the robot travels; this makes programming robots using timing unpredictable. The rotation sensor counts how many times the wheel turns, therefore robot movement becomes more predictable.
- A rotation sensor provides analog feedback, which is a range of numbers.
- The rotation sensor gives both negative and positive feedback.
- The rotation sensor needs to be reset before it can be used. If the user forgets to reset the rotation sensor, it will continue to count, rather than begin to count at zero.
- Campers should know that 1/16th of a revolution is 22.5 degrees.
- Every time a rotation sensor turns one revolution it counts 16 clicks.
- Feedback from the rotation sensor can be seen immediately on the view screen of the RCX. Demonstrate how to use the view screen to see feedback from the sensor.

The Wait for Rotation icon

The “wait for rotation” icon is demonstrated in:

[Lodge / Training / Rotation Sensors / Move Straight](#)
[Lodge / Training / Rotation Sensors / Point Turns](#)

When campers have completed the programming exercises you can assign them another exercise from the “Trek”, or have them write a program to move the robot through their own “custom” camper developed challenge.



What might your students have trouble with today?

- Integrating sensors, grippers, etc. onto their robot. These are mechanical design problems; many campers will need direction implementing their ideas.
- Assigning the proper port to the icon and then actually connecting the sensor to the right port. Often campers will modify their robot and it will no longer work the same because it may be wired differently.
- Calculating rotation sensor distance. Remind campers that as the wheel diameter changes so does the distance traveled per tick. This provides an opportunity to show campers how to calculate distance traveled per tick based on wheel size.
- The rotation sensor icon counts in absolutes so there is no need to put a negative sign there.
- Determining which is better to use: "the rotation sensor fork" or the "wait for rotation" icon.
- Students often find their programs not working because they forget to reset the sensors. Remind your students to get in the habit of resetting their sensors each time they use the rotation sensor.

Learning Objectives for Session 4

- Students should be able to explain the rotation sensor.
- Students should be able to attach a rotation sensor to their robot.
- Students should be able to program their robot, using a rotation sensor, to complete a camp challenge.

Session 5

Introduction to Light Sensors

Light sensors are very reliable and significantly enhance a robot's functionality. Note that these lessons can be confusing to beginners. Do not move too quickly. Check for understanding by having campers complete all of the activities in the light sensor programming section on the "Lodge". After campers complete the programming exercises, assign them the task of "Delivering the mail". This challenge can be found in:

[Trek / Mail](#)

Extension activities for advanced campers

Typically, camps will contain a mix of campers with diverse skill sets. In order to challenge more advanced campers, you can modify any of the activities to make them simpler or more difficult. Additional challenges you can use include:

[Lodge / Frogs](#)
[Lodge / Camp](#)

These challenges are designed to incorporate all camper-learning to date. Continually encourage campers to use feedback from sensors. Campers will want to use timing.

What to cover in this Session

A light sensor sends analog feedback to the robot. The light sensor system consists of two parts: a photo-transistor and a light emitting diode. The light emitting diode projects light, the photo-transistor reads either the reflected light or if there is no reflected light it reads the ambient light in the room. An illustration of how the sensor works can be found at: [Lodge / Hardware / Sensors / Light Sensors](#). Campers need to remember several things when working with light sensors:

- A light sensor reads the light by sending out a signal from a Light Emitting Diode and then reading what ever reflects off the surface that the light hits with a Photo-transmitter. For the best feedback the light sensor should be as close as possible to the surface that it is trying to get feedback from (about 6 millimeters or 1/4 inch).

- The light sensor reads values between 0-100; darker values are represented by lower numbers and lighter values are represented by higher numbers.
- Campers need to be able to connect a light sensor to their robot. There are many ways to do this; beginners may want to start with [Lodge / Hardware / Attachments / Light Sensor](#).
- The programmer needs to calculate the value of threshold when using a light sensor. Threshold is the value between light and dark. (Any value below the threshold is considered by the robot to be dark, while any value above threshold is consider to be light).

Programming Exercises

1. Write a program that uses a light sensor and upload it to your robot.
2. Run the robot one time. This is a very important step that new RCX users often neglect. You need to run the program one time so that the robot knows what type of feedback to expect on the port; analog or digital.
3. Press the view button on the RCX until the view screen indicator (little triangle) is aligned with the port from which you want feedback. (If the light sensor is connected to port one, then the indicator should align with port one. You will know if you are aligned because the values on the view screen will continue to change as the light sensor moves around.)
4. Place the light sensor so that it is pointing over white and record your reading, keeping the sensor close to the surface for the best reading.
5. Place the light sensor so that it is pointing over black and record your reading, keeping the sensor close to the surface for the best reading.
6. Add the values together and divide by two; this gives you the value of threshold. This will be the modifier value that you will use when you use the light sensor.

Go Forward until Dark

Have students program their robot to move forward until the sensor sees a line and stops. Sample code can be found in: [Lodge / Training / Light Sensors / Wait for Dark](#).

Check campers understanding of the following:

1. Threshold value calculation
2. Using the view screen
3. Why is it important to keep the light sensor close to the surface you are reading?

Follow a Line (forks and fork merges)

Demonstrate a robot following a line. Ask students to give ideas on how this works.

A simple line following program uses a nested conditional statement. The conditional statement is executed inside the jump and the land (loop). The line track program is designed to continuously check the value the light sensor sees. The value the sensor sees is then translated into a number and based on that number and the threshold value the RCX will turn on one motor or the other. This procedure repeats itself forever if the programmer used jumps and lands. An example of this code can be found in: [Lodge / Training / Light Sensors / Line Track](#).

Line Track using a Timer Fork (nested conditional statements)

The first line track challenge campers will complete is a simple line track that executes "forever". This program demonstrates how line tracking programs work, but isn't necessarily useful. The program becomes much more useful when campers can write a program that tracks a line for a controlled condition. The next exercise challenges campers to write a program that tracks a line for an amount of time: [Lodge / Training / Light Sensors / Line Track - Timer](#).



In this example campers need to remember the following:

1. Any time a programmer uses a timer they must reset the timer. This is done using the zero timer icon.
2. ROBOLAB can use up to three different timers simultaneously. Timers use modifiers, be sure to connect the modifiers to both the “zero timer” icon and the “timer sensor fork” icon.
3. Campers often place the land before the “zero timer” icon. This resets the timer and the robot tracks the line forever.
4. Calculate threshold.
5. Place the proper modifiers on the sensor.

What might your students have trouble with today?

- Modifiers— modifiers should be used at all levels of programming with ROBOLAB. ROBOLAB uses default values when the programmer doesn't place a modifier, this simplifies programming for the beginner. As programs become more complete it is good practice to add the appropriate modifier at all times.
- Threshold— campers often have difficulty understanding this important concept.
- Using multiple sensors— As campers begin to use multiple sensors, they often forget to identify the ports the sensors are connected to.
- Light sensor placement— light sensors should be placed low on the robot if they are going to be used to read lines on the table. If the sensor is placed high relative to the surface it is reading, the readings from the sensor can become distorted as light conditions in the room change.
- Nested conditional statements— this is powerful programming concept. It is important to give campers plenty of practice reinforcing this topic.

Learning Objectives for Session 5

Campers should be able to:

- Explain the systems that make up a light sensor
- Construct a light sensor attachment
- Use the view screen on the RCX to read the feedback from the light sensor
- Calculate threshold
- Program their robot to move forward until it sees a dark line
- Program their robot to track a line
- Program their robot to track a line for a specific amount of time

Session 6

Robot Challenges...

Problem solving, Sensor integration, Advanced programming

Campers use their growing knowledge of light sensors, rotation sensors, and touch sensors to complete the multiple camp challenges. Depending on the skill level of your campers and staff they may or may not have completed all of the challenges found in the first two sections of Dataloggers; the Lodge and the Trek.

You might want to institute a checklist of all programming/engineering challenges and have campers attempt to complete all of them. Each camp is run differently and so the decision will be left to the camp director. (In the camps run by the Robotics Academy we give multiple awards at the end of the camp to all campers.) Below is a list of the challenges in the first two sections:

Trek / Training Tasks

Mail Delivery, Watering the Flowers, Plant Trees, Pick up Puppy

Lodge / Training

Motors and Timers / 5 exercises

Touch Sensors / 4 exercises

Light Sensors / 4 exercises

Rotation/Angle Sensors / 3 exercises

Trek / Advanced Challenges

Counting the Frogs / Camping

The last two challenges are designed to incorporate all camper-learning to date. Continually encourage campers to use feedback from sensors. Campers will want to use timing because it is easier for them to program.

Students can build attachments that will allow them to complete the above challenges.

What to cover in this session

Session 6 will be a day when students can really test their newly acquired skills. Campers will be assigned to complete several of the challenges as directed by the camp director.

Issues for the camp director to consider

- The level of understanding of their campers— It doesn't make sense to have multiple difficult challenges if campers are frustrated. Move from group to group and help all campers. If there is a problem that is common across all groups, then bring everyone together and review the concept
- The resources that your camp has— not all camps will have the ability to run every challenge. Feel free to modify the challenges as you see fit.

Sessions 7-10

The Green Geyser Wilderness Park Missions...

Culminating Competition / Challenges / Activity

The culminating event of Robotics Academy camps is the final set of challenges, which unfolds as a competition and adventure. The Dataloggers finale— the arrival at Green Geyser Wilderness Park— takes place somewhere in the U.S. west. There are eleven missions that campers can attempt to solve. We always let the campers decide the missions they want to attempt. They need to look at the difficulty of the mission, the amount of points awarded, and their interest in the challenge.

We hold the competition either on graduation day or the day before graduation. The advantage of holding the competition on graduation day is that parents get to see the campers compete. The disadvantage is that the camp director may get stuck sorting everything at the end of the day because parents and campers will want to leave after the competition.

The game board can either be made by you before camp or it can be part of the camp activity. You may assign campers that are ahead of other campers to build the artifacts that make up the camp. We would caution camp directors that this can take considerable time.

The Green Geyser Park missions are:

Salvage Storm-damaged Bridge

Take Fallen Trees to Saw Mill

Sample Microbacteria from Geyser

Drop Radio Collar on Grizzly Bear

Rescue Pack Rat & Crew

Deliver Battery Pack to Visitor's Center

Reposition the Park Gate

Unlock the Wind Turbine

Place Knotty Pine Seedlings in Circles

Clear Avalanche Rocks from Park loop road

The camp director is able to modify or change any of the activities to fit the needs of their robotics camp. Awards should be given during the graduation ceremony. Our goal is that every camper takes multiple awards home.

Summary

Best of luck as you embark on this educational adventure. The Robotics Academy website is a good place to visit for ongoing information about camps, robots, and everything related.

Good luck,

The Robotics Academy staff